Lava Layering

Purpose

To learn about the stratigraphy of lava flows produced by multiple eruptions.

Background [also see "Teacher's Guide" Pages 3, 4, 12, 13]

Dark, flat **maria** (layers of **basaltic lava** flows) cover about 16 percent of the Moon's total surface. They are easily seen on a full Moon with the naked eye on clear nights from most backyards. The maria, quite similar to Earth's basalts, generally flowed long distances utlimately flooding low-lying areas such as **impact** basins. Yet, the **eruption sources** for most of the lunar lava flows are difficult to identify. The difficulty in finding source areas results from burial by younger flows and/or erosion from meteoritic bombardment.

Generally, the overall slope of the surface, local topographic relief (small cliffs and depressions), and eruption direction influence the path of lava flows. Detailed maps of the **geology** of the Moon from photographs reveal areas of complicated lava layering. The study of rock layering is called **stratigraphy**.

On the Moon, older flows become covered by younger flows and/or become more pocked with impact craters.

On Earth, older lava flows tend to be more weathered (broken) and may have more vegetation than younger flows. Field geologists use differences in roughness, color, and chemistry to further differentiate between lava flows. They also follow the flow margins, **channels**, and **levees** to try to trace lava flows back to the source area.

The focus of this activity is on the patterns of lava flows produced by multiple eruptions. We use a short cup to hold the baking soda because we are looking at the flows and not at constructing a volcano model. Volcanoes, like those so familiar to us on Earth and Mars, are not present on the Moon. Three well-known areas on the Moon interpreted as important volcanic complexes are: Aristarchus plateau, and the Marius Hills and Rumker Hills (both located in Oceanus Procellarum). These areas are characterized by sinuous rilles (interpreted as former lava channels and/or collapsed lava tubes) and numerous domes.

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Preparation

Baking soda-vinegar solutions and playdough are used to model the basaltic lavas. Different colors identify different eruption events; this activity calls for 4 colors. Students will be asked to observe where the flows traveled and to interpret the stratigraphy. Cover the work area and be prepared for spills.

Play Dough (stove-top recipe)

-best texture and lasts for months when refrigerated in an air tight container.

2 cups flour	1/3 cup oil, scant
1 cup salt	2 cups cold water
4 teaspoons cream of tarter	food colorings (20 drops more or less)

Make this large batch one color or divide ingredients in half to make 2 colors. You will need 4 colors total. Combine ingredients and cook mixture in a large sauce pan, stirring constantly, until the dough forms a ball. Turn dough out onto a floured surface to cool. Then kneed until smooth and elastic. Cool completely; refrigerate in air tight containers.

Play Dough (no-cooking recipe)

2 cups flour	2 Tablespoons oil
1 cup salt	1 cup cold water
6 teaspoons alum or cream of tartar	food colorings (as above)

Make this large batch one color or divide ingredients in half to make 2 colors. You will need 4 colors total. Mix ingredients and kneed until smooth and elastic. Store in air tight containers.

In Class

This activity can be done individually or in cooperative teams.
Making a vertical cut through the flows reveals, quite dramatically, the stratigraphy of the section.

Wrap-up

Have students compare their layered lava patterns with their classmates' patterns. Did they recognize individual flows by color and outline? Point out how the oldest flow is on the bottom of the stack and the youngest flow is on top.

Extensions

Groups can trade landscapes before answering the questions. Clear, plastic drinking straws can be pushed down into the landscapes to extract “drill” samples of the layers.

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Key Words

eruption

source

stratigraphy

Materials

paper cups, 4 oz. size, some cut down to a height of 2.5 cm

cafeteria tray or cookie sheet, 1 for each eruption source

tape

tablespoon

baking soda

measuring cup

vinegar

food coloring, 4 colors; for example, red, yellow, blue, green

playdough or clay in the same 4 colors as the food coloring

plastic knife, string, or dental floss: to slice through the layers of playdough

Procedure

1. Take one **paper cup** that has been cut to a height of 2.5 cm and secure it onto the **tray**. (You may use a small loop of **tape** on the outside bottom of the cup.) This short cup is your eruption source and the tray is the original land surface.

2. Place one **Tablespoon of baking soda** in this cup.

3. Fill 4 tall paper cups each with **1/8 cup of vinegar.**

4. To each paper cup of vinegar add 3 drops of **food coloring;** make each cup a different color. Set them aside.

5. Set aside small balls of **playdough**, one of each color.

6. You are now ready to create an eruption. Pour red-colored vinegar into your source cup and watch the eruption of "lava."

7. As best you can, use red playdough to cover the areas where red "lava" flowed.

8. Repeat steps 6 and 7 for each color of vinegar and playdough. You may add fresh baking soda to the source cup or spoon out excess vinegar from the source cup as needed.

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Results

1. After your four eruptions, can you still see the original land surface (tray)? Where?

2. Describe what you see and include observations of flows covering or overlapping other flows. Use the left page margin to make a sketch.

3. Where is the oldest flow?

4. Where is the youngest flow?

5. Did the flows always follow the same path? (be specific)

6. What do you think influences the path direction of lava flows?

7. If you had not watched the eruptions, how would you know that there are many different layers of lava? Give at least 2 reasons:

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8. Which of the reasons listed in answer 7 could be used to identify real lava layers on Earth?

9. What are other ways to distinguish between older and younger layered lava flows on Earth?

10. Which of the reasons listed in answer 9 could be used to identify lava layers on the Moon?

11. What are other ways to distinguish between older and younger layered lava flows on the Moon?

12. Make a vertical cut through an area of overlapping playdough "lava" layers. Draw what you see in the vertical section. Color your sketch and add these labels:
oldest flow, youngest flow.

Vertical section through the flows